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The North Otago Shelf Fauna Part I—Mollusca

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Abstract

THE 259 identified species of mollusca from the shelf off North Otago, collected during the five years 1957–61, are listed. A brief description of the sea-bed biotope is given and the pattern of molluscan distribution illustrated. The effects of commercial trawling and other factors on the natural dispersal of species are discussed.

INTRODUCTION

APART from six stations worked off North Otago by the New Zealand Government Trawling Expedition of 1907, the writer is not aware of any ecological investigations on this part of the New Zealand coast. The area can claim significance only because it is situated away from the existing centres of marine biological research and is crossed by the 45° S. parallel. It is also influenced by subantarctic surface waters and forms the northern boundary of the Forsterian faunal province since it merges into the long shingle beaches, with impoverished fauna (Powell, 1957), which separate it from the Cookian.

The checklist of mollusca is based on material taken by commercial fishing trawl at sea, collected intertidally or found cast upon the beaches during 1957–61 inclusive. The author has compared all subsequent specimens with those initially identified for him by specialists. Other phyla will be discussed in subsequent contributions.

This study does not pretend to be exhaustive as it suffers from the restrictions imposed by commercial trawling methods. The considerable area where trawling is impracticable because of rock-fouls and weed-infested bottom; the comparatively long distances covered in each trawling operation (average, five miles); the large size of netting meshes and the dictates of commercial reward necessarily place it short of a complete survey of the fauna. While many organisms will escape from the commercial net (as is intended) surprisingly large numbers of small specimens are taken. These are recovered from the bottom debris swept up by the trawl, are embedded in mud, tangled in weeds or trapped in sponge or mollusc colonies. The holdfast of the ascidian *Pyura pachydermatina*, for example, is a source of small specimens as are also the clusters of the prolific

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and wide-spread polychaete worm, *Phyllochaetopterus socialis,* while even the wing meshes of the net will capture an open bivalve, an echinoderm or, as happened on two occasions, such smooth objects as the shell of the mollusc, *Baryspira mucronata.* Some specimens are symbiotic with, or commensal on, larger material. By continually trawling over a specific area a representative selection of animals may be noted and/or collected so that, eventually, a clearer ecological pattern will emerge. Thus, extensive operations have the effect of negating, to an appreciable extent, the inadequacy of the method used.

The commercial fishing trawl used conforms to the New Zealand Fisheries (general) Regulations 1950 and its Amendments. It has a 20 m ground-rope, which sweeps the floor of the sea, and is attached to conventional otterboards by extensions of 46 m of steel cable. These extensions are designed to flay the bottom on either side, but slightly ahead and so frighten the fishes in and towards the open net. The head-line is buoyed up by spherical steel floats which give the trawl a gape of approximately three metres. A similar, although larger, trawl was used by the *Nora Niven* in the 1907 expedition (Waite, 1909).

The political sub-province of North Otago is situated on the east coast of the South Island of New Zealand. Oamaru is the port and chief town. The specific area under consideration is bounded in the north by the mouth of the Waitaki River (44° 56′ S.) and in the south by the mouth of the Kakanui River (45° 12′ S.) and extends out to depth of 120 m. This is roughly 35 km square, although the contour of the coast and the irregularity of the maximum depth pattern elongates the figure extremely to the north-east. The depth of 120 m is not only the effective working depth of the vessel used but is also physically imposed for one-third of the trawling distance by the northern extremity of the Otago Canyon (locally known as "The Crack") as the bottom there falls away precipitously to over 550 m.

Approximately only half the area is fishable by trawl. A triangle formed by a line 110° S. from the Oamaru Harbour to 82 m depth and thence to Moeraki Point is largely composed of rocky bottom that cannot be trawled with safety. Also, the heavy-shingle bottom adjacent to Oamaru Harbour and north to the Waitaki River mouth gives firm anchorage to the bladder kelp, *Macrocystis* sp., the growth of which is so prolific that, at slack tides, it floats in great masses on the surface. This kelp-bed ranges from the shore breakers in 9 m to about 13 km offshore in 27 m of water, and thereby prevents trawling over an extensive area.

As the use of charted stations is impracticable, the author has divided the area into 4 zones based on bottom type and actual fishing-ground boundaries used in his operational records.

Zone 1

Inter-tidal rocks, exposed at low tide, north and south of the Kakanui River mouth and those around Cape Wanbrow, the intervening beaches and the Oamaru Harbour.

Zone 2

9 to 55 m. Apart from a small coastal strip immediately north of Oamaru Harbour, this area is in effect from 27 m (beyond the kelp) to 55 m. The inshore shingle merges into a coarse, brown gravel and finally into a muddy shell-sand. On this ground the trawl comes up with large quantities of shells heavily encrusted with sponges, barnacles and polyzoans; colonies of some species of the Mytilidae

infested with polychaetes; stalked and other ascidians and many species of algae and hydroids.

Zone 3

Beyond 55 m and out to 88 m is a large area known locally as the "hay paddock". This muddy shell-sand and broken polyzoan bottom supports a vast meadow of so-called "tarakihi weed" (i.e., a polychaete worm, *Phyllochaetopterus socialis*) and also numerous other species. Bobbins (to raise the ground-rope slightly from the bottom) must be used otherwise the net will fill with debris after only a short time trawling.

Zone 4

Between 88 and 120 m the bottom is generally muddy shell-sand and, apart from an abundance of a small orange-coloured finger sponge on the south end, is excellent for trawling. The area is confined in the south-east and east by the brink of the Otago Canyon, but fans out to the north-east beyond the limits of Oamaru-based day trawlers.

CHECKLIST OF MOLLUSCA FROM NORTH OTAGO SHELF

ABBREVIATIONS. 1, Zone 1; 2, Zone 2; 3, Zone 3; 4, Zone 4; C, common; U, uncommon; R, rare; d, dead; b, cast on beach; P, initially identified by Dr A. W. B. Powell; D, initially identified by Dr R. K. Dell. Where not otherwise indicated, identifications are those of the author.

BIVALVIA

NUCULIDAE
Nucula hartvigiana Pfeiffer 1U, 2U, 3U, 4U, P.

NUCULANIDAE
Nuculana bellula (A. Adams) 3U, 4U, P.
Poroleda lanceolata (Hutton) 3R, P.

ARCIDAE
Barbatia novaezelandiae Smith 1Cb, 2U, 3U, 4U, D.

GLYCYMERIDAE
Glycymeris laticostata (Q & G) 1Ub, 2C, P.
G. modesta (Angas) 1Ub, 2U, P.

PHILOBRYIDAE
Hochstetteria pinctada Finlay 3R, 4R, P.
Cosa filholi (Bernard) 3R, 4R, P.

MYTILIDAE
Perna canaliculus (Gmelin) 1C, 2U, D.
Mytilus edulis aoteanus Powell 1C, P.
Aulacomya maoriana (Iredale) 1C, 2C, 3C, P.
Modiolus areolatus (Gould) 1Ub, 2C, 3C, 4U, P.
Rynella impactus (Hermann) 1Cb, 2C, 3U, 4U, P.
Zelithophaga truncata (Gray) 2R, D.

PINNIDAE
Atrina zelandica (Gray) 2U, 3U, 4R, D.

PECTINIDAE
Pecten novaezelandiae rakiura Fleming 1Rb, 2U, 3R, P.
Chlamys celator Finlay 1Cb, 2C, 3C, 4C, P.
C. gemmulata radiata (Hutton) 1Ub, 2U, 3C, 4C, P.
Chlamys suprasilis suprasilis Finlay 2R, D.
C. taiaroa Powell 3R, 4R, P.
C. zeelandona (Hartlein) 1Rb, 2R, P.
C. delicatula (Hutton) 2R, 3R, 4R, P.
Pallium convexum (Q & G) 1Rb, 2R (1 only), P.

LIMIDAE
Lima zelandica Sowerby 2U, 3U, 4U, P.
Limatula maoria Finlay 2U, 4R, D.

ANOMIIDAE
Monia zelandica (Gray) 2U, 3U, 4U, P.
M. furcata (Suter) 3R, P.
Monia sp. 2U, 3U, 4U, P.

OSTREIDAE
Ostrea charlottae Finlay 2C, 3C, 4C, P.
O. sinuata Lamarck 1C, P.

CARDITIDAE
Cardita aoteana Finlay 1Rd, 2U, 3U, P.
Venericardia purpurata (Deshayes) 2Ud, 3U, 4U, P.
Pleuromeris zealandica (Deshayes) 2Ud, 3C, 4C, P.

PERRIERINIDAE
Perrierina taxodonta Bernard 3R, 4R, P.

LUCINIDAE
Divaricella huttoniana Vanatta 3Rd, 4Rd, P.

LEPTONIDAE
Lasaea hinemoa Finlay 1C, P.
Marikellia rotunda (Deshayes) 2U, 3U, P.

MONTACUTIDAE
Rochefortula reniformis (Suter) 2R, 3R, P.
CARDIIDAE
Nemocardium pulchellum (Gray) 2U, 3U, 4U, P.
VENERIDAE
Dosinia lambata (Gould) 2Rd, 3R, 4Rd (1 valve), P.
D. anus (Philippi) 1Rb, P.
D. greyi Zittel 2R, 3Rd, 4Rd, P.
Notocallista multistriata (Sowerby) 2Rd, 3Ud, 4Ud, P.
Dosinula zelandica (Gray) 1Rb, 2C, 3U, 4Rd, P.
Tawera spissa (Deshayes) 1Cb, 2C, 3C, P.
Chione stutchburyi (Gray) 1Cb, P.
Notopaphia elegans (Deshayes) 1Rb, P.
Protothaca crassicosta (Deshayes) 1C, P.
Paphirus largillerti (Philippi) 1Cb, 2Ud, P.
Notirus reflexus (Gray) 1Ud, 2Rd, P.
TELLINIDAE
Tellinella eugonia (Suter) (single valves) 2Rd, 3Rd, P.
Zearcopagia disculus (Deshayes) 1Rb, P.
SEMELIDAE
Leytomya retiaria retiaria (Hutton) 3Rd (1 only), D.
SANGUINOLARIIDAE
Gari lineolata (Gray) 1Rb, 2Ud, 3Ud, P.
G. stangeri (Gray) 1Ub, 2Ud, P.
Ascitellina urinatoria (Suter) 2R, P.
MACTRIDAE
Mactra discors (Gray) 1Cb, P.
Cyclomactra ovata (Gray) 1Rb (single valves) P.
Longimactra elongata (Q & G), 1Ub, 2C, 3Ud, P.
Maorimactra ordinaria (Smith) 1Cb, P.
Scalpomactra scalpellum (Reeve) 2U, P.
Spisula aequilateralis (Deshayes) 1Cb, P.
Zenatia acinaces (Q & G) (single valves) 2Rd, 3Rd, P.
AMPHIDESMATIDAE
Amphidesma forsterianum Finlay 1Cb, P.
HIATELLIDAE
Hiatella australis (Lamarck) 2U, 3U, P.
Panopea smithae Powell 2U, 3Rd, 4Rd, P.
CORBULIDAE
Notocorbula zelandica (Q & G) 2U, 3U, P.
PHOLADIDAE
Anchomasa similis (Gray) 1Ud, D.
Pholadidea spathulata (Gray) 1Cd, P.
TEREDINIDAE
Teredo antarctica Hutton 1U, 3Rd.
MYOCHAMIDAE
Myadora novaezelandiae E. A. Smith 2Ud, 3Ud, 4Ud, P.
M. striata (Q & G) 2Rd (single valve), D.
M. subrostrata E. A. Smith 2R, 3R, P.
THRACIIDAE
Thracia vitrea (Hutton) (single valves) 3Rd, P.
CUSPIDARIIDAE
Cuspidaria trailli (Hutton) (single valves) 3Rd, P.

GASTROPODA

HALIOTIDAE
Haliotis iris Gmelin 1C, 4Rd (probably carried on kelp), P.
Haliotis australis Gmelin 1U, D.
H. virginea virginea Gmelin 1Cb, 2U, P.
FISSURELLIDAE
Emarginula striatula (Q & G) 1Ub, 2U, 3U, 4R, P.
Tugali stewartiana Powell 2U, 3C, 4C, P.
Monodilepas otagoensis Finlay 3U, 4U, P.
Scutus breviculus (Blainville) 1C, D.
ACMAEIDAE
Patelloida corticata corticata (Hutton) 1C, P.
P. corticata pseudocorticata (Iredale) 1U, P.
Radiacmea inconspicua inconspicua (Gray) 1U, P.
Notoacmea pileopsis sturnus (Hombron & Jacquinot) 1C, P.
N. parviconoidea (Suter) 1U, P.
N. daedala (Suter) 1C, P.
N. badia (Suter) 1C, P.
Atalacmea fragilis (Sowerby) 1U, P.
PATELLIDAE
Cellana ornata (Dillwyn) 1C, P.
C. radians radians (Gmelin) 1C, P.
C. radians perana Iredale 1C, P.
C. strigilis redimiculum (Reeve) 1C, P.
TROCHIDAE
Trochus tiaratus (Q & G) 1Cb, 2U, P.
T. viridis (Gmelin) 1C, 2U, D.
Thoristella chathamensis benthicola Finlay 2U, P.
T. chathamensis dunedinensis Suter 1U, 3Rd (1 only), P.
Melagraphia aethiops (Gmelin) 1C, D.
Zediloma arida Finlay 1U, P.
Zediloma digna Finlay 1C, P.
Z. atrovirens (Philippi) 1R, D.
Anisodiloma lugubris lenior Finlay 1U, P.
Cantharidus opalus opalus (Martyn) 1U, 2U, D.
Micrelenchus caelatus caelatus (Hutton) 1C, 3R, P.
M. dilatatus (Sowerby) 1C, P.
M. sanguineus cryptus Powell 1C, P.

M. tenebrosus (A. Adams) 1C, 4R (holdfast sunken kelp), P.
Cantharidella tesselata (A. Adams) 1C, P.
Maurea blacki Powell 3R (1 alive only), 4Rd, P.
M. cunninghami pagoda (Oliver) 2U, 3U, 4R, P.
M. pellucida pellucida (Valenciennes) 2R, 3U, 4U, P.
M. punctulata multigemmata Powell 2R, 3U, 4U, P.
M. punctulata stewartiana (Oliver) 1C, 2U, 3R, P.
M. tigris tigris (Martyn) 1Rb, 2R, 3R, 4Rd, D.

UMBONIIDAE
Antisolarium egenum (Gould) 2Ud, P.
Zethalia zelandica (A. Adams) 1Cb, 2Ud, D.

TURBINIDAE
Lunella smaragda (Gmelin) 1C, D.
Modelia granosa (Martyn) 1Rb, 2U, D.
Astraea heliotropium (Martyn) 1Rb, 2C, 3C, 4U, P.
Cookia sulcata (Gmelin) 1C, D.

LITTORINIDAE
Melarhaphe cincta (Q & G) 1C, P.
M. oliveri Finlay 1C, P.

BEMBICIIDAE
Risellopsis varia (Hutton) 1C, P.

RISSOIDAE
Estea rekohuana Powell 1U, P.
Haurakia huttoni (Suter) 4R, P.
Linemera gradatoides Finlay 3R, P.
Notosetia microstriata (Murdoch) 4R, P.
N. novaezelandica (Suter) 4R, P.
Notosetia sp. 4R, P.
Dardanula sp. 4R, P.

RISSOINIDAE
Rissoina chathamensis (Hutton) 1C, P.

CERITHIIDAE
Socienna maoria Finlay 4R, P.

TRIPHORIDAE
Notosinister fascelinus (Suter) 3Rd, P.
N. huttoni (Suter) 4Rd, P.
N. luteus (Suter) 4Rd, P.

TURRITELLIDAE
Maoricolpus roseus (Q & G) 1Ub, 2C, 3C, 4C, P.
Stiracolpus symmetricus symmetricus (Hutton) 2Cd, 3Cd, 4C, D.

EPITONIIDAE
Cirsotrema zelebori (Dunker) 2Rd, P.

STILIFERIDAE
Stilifer n. sp. 1R, P.
Venustilifer bountyensis (Powell) 2R, 3R, P.

TRICHOTROPIDAE
Trichosirius cavatocarinatus (Laws) 2Rd, D.
T. inornatus inornatus (Hutton) 2R, 3R, P.

CAPULIDAE
Capulus calcareus Suter 4R, P.
Neojanacus perplexus Suter 2R, P.

CALYPTRAEIDAE
Sigapatella novaezelandiae Lesson 1C, 2C, 3C, D.
Zegalarus tenuis (Gray) 1Ub, 2Ud, 3Rd, P.
Maoricrypta monoxyla (Lesson) 2C, 3C, 4C, D.

STRUTHIOLARIIDAE
Struthiolaria papulosa gigas Sowerby 1Rb, 2Ud, 3Ud, 4Ud, D.
S. vermis (Martyn) 2Rd, P.
S. tricarinata (Lesson) 2Rd, 4Rd, P.

LAMELLARIIDAE
Lamellaria cerebroides Hutton 2U, 3C, 4U, D.
Mysticoncha harrisoni Powell 2R, 3R, 4R, D.

NATICIDAE
Tanea zelandica (Q & G) 1Ub, 2U, 3U, 4Ud, P.
Uberella denticulifera (Marwick) 2Rd (1 only), P.

CASSIDIDAE
Xenophalium finlayi Iredale 2Rd, 3U, 4U, P.

CYMATIIDAE
Cabestana spengleri (Perry) 1Rb, 2R, P.
Charonia capax Finlay 2U, 3U, 4R, P.
Argobuccinum tumidum (Dunker) 1Ub, 2C, 3C, 4C, P.
Mayena australasia australasia (Perry) 2R (1 only), P.
M. australasia blacki Powell 2U, 3U, 4U, P.
Fusitriton laudandum Finlay 2Rd, 3U, 4C, P.
Ranella multinodosa (Bucknell) 4R (1 only), P.

MURICIDAE
Poirieria zelandica (Q & G) 2Rd, 3R, 4Rd, D.
Zeatrophon ambiguus (Philippi) 2U, 4R, P.
Zeatrophon pulcherrimus Finlay 2R, 4R, P.
Z. pumilus (Suter) 3R (1 only), P.
Xymene plebejus (Hutton) 1U, 2U, P.
Axymene corticatus (Hutton) 2Ud, P.
A. traversi convexus (Suter) 3Rd, 4Rd, P.
A. traversi erectus (Suter) 3U, 4U, P.
A. turbator Finlay 1C, 2C, P.
Axymene sp. 2Rd, P.
Paratrophon patens (Hombron & Jacquinot) 1C, P.

THAISIDAE
Lepsiella scobina scobina (Q & G) 1R, D.
L. scobina albomarginata (Deshayes) 1C, P.
Lepsithais lacunosus (Bruguiére) 1C, P.

COLUMBELLIDAE
Zemitrella sulcata (Hutton) 2U, 3U, 4U, P.
Paxula murdochi Finlay 1Ud, 2Ud, P.
P. paxillus (Murdoch) 1Ud, P.
Paxula sp. 1Rd, P.

BUCCINULIDAE
Buccinulum pallidum Finlay 1U, P.
B. finlayi Powell 2U, 3U, 4R, P.
B. mutabile Powell 1Ub, 2R, P.
B. littorinoides (Reeve) 1C, P.
B. strebeli strebeli (Suter) 1C, P.
B. Sterbelli exsculptum Powell 1Rd, 4R, P.
Euthrenopsis otagoensis Powell 2U, 3U, 4U, P.
Penion fairfieldae Powell 3C, 4C, P.
P. mandarina (Duclos) (2 only) 1Rb, 4Rd, P.
Aeneator otagoensis Finlay 3Rd (2 only), P.
Ellicia recens Dell 3Rd, 4Rd, P.

NEPTUNIIDAE
Austrofusus chathamensis Finlay 1Rb, 2Rd, 4Rd, P.
A. glans (Roeding) 1Rb, 2C, 3C, 4C, P.

COMINELLIDAE
Cominella otakauica Powell 2U, 3U, 4U, P.
C. glandiformis (Reeve) 1R (2 only), P.
Eucominia sp. 3R, D.

COLUMBARIIDAE
Coluzea mariae Powell (2 only), 3Rd, 4Rd, P.

FASCIOLARIIDAE
Glaphyrina vulpicolor (Sowerby) 2R, 3U, 4R, P.

OLIVIDAE
Baryspira mucronata (Sowerby) 2Rd, 3Rd, P.
B. novaezelandiae novaezelandiae (Sowerby) 3Rd (1 only), P.

MITRIDAE
Austromitra rubiginosa (Hutton) 2R, P.
Microvoluta biconica (Murdoch & Suter) 3Rd, P.

VOLUTIDAE
Pachymelon smithae Powell 2Rd, 4Ud, P.
Alcithoe calva Powell 3R, 4R, P.
A. jaculoides Powell 2U, 3C, 4C, D.
A. swainsoni swainsoni Marwick 1Cb, 2C, 3U, 4U, P.
A. fusus fusus (Q & G) 2Rd, 4Rd, P.
Alcithoe n. sp. (no depth record), P.
Iredalina aurantia Powell 2Rd (1 only), 3Rd, 4Ud, P.
I. mirabilis Finlay 4Rd (2 only), P.

TURRIDAE
Comitas trailli (Hutton) 2Ud, 3Ud, 4Ud, P.
Antimelatoma benthicola Powell 3U, 4U, P.
Splendrillia aoteana Finlay 3U, 4U, P.
S. otagoensis Powell 4R, P.
Phenatoma novaezelandiae (Reeve) 1Rb.
Mitrithara gemmata (Suter) 3U, 4U, P.
Neoguraleus murdochi (Finlay) 2R, P.
N. sinclairi (Gillies) 1Ud, P.
Antiguraleus otagoensis Powell 2R, P.
Liracraea ependroma (Murdoch) 4Rd, P.

ONCHIDIIDAE
Onchidella nigricans (Q & G) 1U, P.

SCAPHANDRIDAE
Cylichnina striata (Hutton) 3Rd, 4Rd, P.

PYRAMIDELLIDAE
Agatha georgiana (Hutton) 2R, 3U, 4U, P.
Chemnitzia zelandica zelandica (Hutton) 4R, P.

PLEUROBRANCHIDAE
Bouvieria ornata (Cheeseman) 1U, P.

CHROMODORIDAE
Glossodoris aureomarginata (Cheeseman) 2U, 3U, 4U, D.

DORIDAE
Archidoris wellingtonensis (Abraham) 2C, 3C, 4C, D.

ELLOBIIDAE
Marinula filholi Hutton 1U, P.
Leuconopsis obsoleta (Hutton) 1U, D.

AMPHIBOLIDAE
Amphibola crenata (Martyn) 1Rb, D.

SIPHONARIIDAE
Siphonaria australis (Q & G) 1C, 2Rd (1 only—washed out), P.
S. zelandica (Q & G) 1C, 4R (on kelp hold-fast), P.
Benhamina obliquata (Sowerby) 1C, P.

TRIMUSCULIDAE
Gadinalea nivea (Hutton) 1R, P.

AMPHINEURA

ISCHNOCHITONIDAE
Ischnochiton maorianus Iredale 1C, P.

LEPIDOPLEURIDAE
Terenochiton otagoensis Iredale & Hull 1C, P.
Terenochiton sp. 1R, P.

LEPIDOCHITONIDAE
Eudoxochiton nobilis (Gray) 1U, D.

CRYPTOCONCHIDAE
Cryptoconchus porosus 1C, 2U, 3R.
Acanthochiton zelandicus amplificatus (Iredale & Hull) 1U, P.
Notoplax facilis Iredale & Hull 2R, 3R, P.
N. violacea (Q & G) 1C, P.
Craspedochiton rubiginosus (Hutton) 2U, 3U, P.

PLAXIPHORIDAE
Maorichiton metonomazus (Iredale & Hull) 1U, P.
Frembleya egregia H. Adams 1U, D.

CHITONIDAE
Anthochiton aereus (Reeve) 1C, P.
A. canaliculatus (Q & G) 2U, P.
Amaurochiton glaucus (Gray) 1C, P.
Sypharochiton pelliserpentis (Q & G) 1C, P.
S. sinclairi (Gray) 1U, P.
Onithochiton neglectus Rochebrune 1C, P.

SCAPHOPODA

DENTALIIDAE

Dentalium nanum Hutton 2Rd, 3Rd, 4Rd, P.

Fissidentalium zelandicum (Sowerby) 3Rd, 4Rd, P.

CEPHALOPODA

OCTOPODIDAE

Octopus maorum Hutton 1C, 2C, 3U, 4R, D.

Robsonella australis (Hoyle) 2U, P.

ARGONAUTIDAE

Argonauta nodosa Solander 4Rd (1 only broken).

SEPIADARIIDAE

Sepioloidea pacifica (T. W. Kirk) 2U, 3U, D.

OMMASTREPHIDAE

Nototodarus sloani (Gray) 2C, 3C, 4C, D.

DISCUSSION

Fishing trawlers ultimately must affect, to some degree, the distributional patterns of species, particularly deeper water animals, which are transported towards port and finally hosed overside in the last act of shipboard cleaning. As all vessels converge on their home port, so must the concentration of the deposit increase in proportion to the decrease in the radius of return. Probably many species fail to adapt to the new temperatures and ecological conditions, particularly having been weakened by exposure and, in the case of molluscs, cirripedes or polyzoans, the remains could be swept up in the future as dead material. Some species which survive this involuntary migration may flourish far from their natural habitat. So few trawlers have operated to date from North Otago port of Oamaru that this factor will have had little effect. Outside major and long-established trawling ports, however, there must be considerable interference with natural distribution.

The hermit crabs, *Eupagurus* spp., must share the responsibility for the transportation of some dead gastropod shells. The author has never taken alive some genera, notably *Pachymelon* and *Iredalina*. Can it be doubted that the crab-tenant has carried his new-found home from the slopes or depths of the canyon which flanks the off-shore grounds? Otherwise, by the accepted principles of average and incidence, a living specimen would surely have been taken in one of the many trawls over this area.

The incidence of dead material, comprising notably molluscs, cirripedes, polychaetes and polyzoans, may therefore have little ecological significance. It has been recorded because some species are represented only by dead shell, exoskeleton or empty casings. Many have been in such clean condition, free from encrustation and other evidence of age, that they are probably lying near their normal habitat.

Concentrated trawling with the use of extensions must destroy large numbers of demersal and sedentary animals. The ultimate effect of this equipment on commercial fishing would be a fruitful though difficult study. A reputable Timaru trawlerman told the author that where " thirty years ago they got large quantities of shells in their nets they seldom now find a specimen of erstwhile common species ". This may be an exaggeration of memory but evidence seems to support this view even on the less exploited North Otago shelf.

It is also evident that as only about half the shelf area off North Otago, as an example, can be trawled any calculations purporting to illustrate New Zealand fishing potential, unsupported by wide local knowledge, are largely valueless. An assessment of the area actually fishable by existing methods should be the logical foundation on which all such research should be based. It would appear, never-

theless, that the inaccessible areas adjacent to the trawling grounds form reservoirs from which the latter are probably replenished.

Sixteen nudibranchs have been taken and are held in preservation pending identification.

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